

What is claimed as new and desired to be secured by  
Letters Patent of the United States is:

1. An acoustic transducer comprising:  
a honeycomb structure having a plurality of cells; and  
each of said cells comprises a piezoelectric transducer.
2. The acoustic transducer as recited in Claim 1 wherein  
each of said plurality of cells comprises a multi-sided cell.
3. The acoustic transducer as recited in Claim 1 wherein  
each of said plurality of cells comprises a cylindrical cell.
4. An acoustic transducer comprising:  
a honeycomb structure having a plurality of cells;  
each of said cells comprises a piezoelectric transducer;  
and  
each piezoelectric transducer comprises a stack having at  
least one piezocomposite element.
5. The acoustic transducer as recited in Claim 4 wherein  
each of said plurality of cells comprises a multi-sided cell.
6. The acoustic transducer as recited in Claim 4 wherein  
said plurality of cells comprises a cylindrical cell.

7. An acoustic transducer array comprising:

a honeycomb structure having a plurality of cells, each of said cells comprises a piezoelectric transducer;

each piezoelectric transducer comprises a stack having at least one piezocomposite element;

each piezocomposite element includes a plurality of piezoceramic elements, said piezoceramic elements being arranged parallel to each other;

said plurality of piezoceramic elements of said piezocomposite element being encapsulated in a polymeric matrix forming said piezocomposite element;

a front planar surface and a back planar surface of said piezocomposite element comprise an electrically conductive layer; and

a soft pressure release material is disposed around each stack except on a surface of said stack facing a front surface of said acoustic transducer array.

8. The acoustic transducer array as recited in Claim 7 wherein said transducer array comprises means disposed adjacent to said plurality of cells for providing waterproofing of said acoustic transducer array.

9. The acoustic transducer array as recited in Claim 7 wherein said honeycomb structure comprises a plurality of multi-sided cells.

5 10. The acoustic transducer array as recited in Claim 7 wherein said honeycomb structure comprises a plurality of cylindrical cells.

10 11. The acoustic transducer array as recited in Claim 7 wherein said honeycomb structure comprises a matrix of a plurality of strips attached together at cross-over points, said strips being made of an impact-resistant material.

12. The acoustic transducer as recited in Claim 7 wherein said honeycomb structure comprises a molded or drilled-out structure made of an impact-resistant material.

15 13. The acoustic transducer array as recited in Claim 7 wherein said piezocomposite element comprises a 1-3 connectivity configuration.

14. The acoustic transducer array as recited in Claim 7 wherein said piezocomposite element comprises a 2-2 connectivity configuration.

15. The acoustic transducer array as recited in Claim 7 wherein each piezocomposite element is separately wired for sensing as a single element.

5 16. The acoustic transducer array as recited in Claim 7 wherein said piezocomposite element is wired for sensing in a phased array configuration.

10 17. The acoustic transducer array as recited in Claim 7 wherein each piezocomposite element is separately wired for transmitting as a single element.

15 18. The acoustic transducer array as recited in Claim 7 wherein each piezocomposite element is separately wired for transmitting in a phased array configuration.

20 19. The acoustic transducer array as recited in Claim 7 wherein said stack comprises said piezocomposite element, an acoustic matching layer adjacent to a front surface of said piezocomposite element, and a stiffening layer adjacent to a back surface of said piezocomposite element.

25 20. The acoustic transducer array as recited in Claim 7 wherein said stack comprises said piezocomposite element and a

stiffening layer adjacent to a back surface of said piezocomposite element.

21. The acoustic transducer array as recited in Claim 7 wherein said stack comprises said piezocomposite element and an acoustic matching layer adjacent to a front surface of said piezocomposite element.

22. The acoustic transducer array as recited in Claim 7 wherein each stack comprises wires extending from said front planar surface electrically conductive layer and from said back planar surface electrically conductive layer of said piezocomposite element for wiring said cells in a predetermined manner for operation of said acoustic transducer as a sensor array.

23. The acoustic transducer array as recited in Claim 7 wherein each stack comprises wires extending from said front planar surface electrically conductive layer and from said back planar surface electrically conductive layer of said piezocomposite element for wiring said cells in a predetermined manner for operation of said acoustic transducer as a transmitter array.

24. The acoustic transducer array as recited in Claim 7 wherein said stack comprises a first piezocomposite element disposed adjacent to a second piezocomposite element, an acoustic matching layer adjacent to a front surface of said first piezocomposite element, and a stiffening layer adjacent to a back surface of said second piezocomposite element.

25. The acoustic transducer array as recited in Claim 7 wherein said stack comprises a piezocomposite element, a first acoustic matching layer positioned adjacent to a front surface of said piezocomposite element, a second acoustic matching layer positioned adjacent to said first acoustic matching layer, and a stiffening layer adjacent to a back surface of said piezocomposite element.

26. The method of providing an acoustic transducer for operation in a rugged environment comprising the step of:  
providing an impact-resistant honeycomb structure having a plurality of cells, each of said cells comprises a piezoelectric transducer.

27. The method of providing an acoustic transducer for operation in a rugged environment comprising the steps of :

providing an impact-resistant honeycomb structure having a plurality of cells, each of said cells comprises a piezoelectric transducer; and

providing a stack in each piezoelectric transducer having at least one piezocomposite element.

28. A method of providing an acoustic transducer array for operation in a rugged environment comprising the steps of:

providing a honeycomb structure having a plurality of cells, each of said cells comprises a piezoelectric element;

providing in each piezoelectric transducer a stack having at least one piezocomposite element;

including a plurality of piezoceramic elements, in each piezocomposite element, said piezoceramic elements being arranged parallel to each other;

forming said piezocomposite element by encapsulating said plurality of piezoceramic elements of said piezocomposite element in a polymeric matrix;

providing an electrically conductive layer on a front planar surface and a back planar surface of said piezocomposite element; and

disposing a soft pressure release material around each stack except on a surface of said stack facing a front surface of said acoustic transducer array.

29. The method as recited in Claim 28 wherein said method comprises the step of providing means disposed adjacent to said plurality of cells for waterproofing said acoustic transducer array.

5 30. The method as recited in Claim 28 wherein said step of providing a honeycomb structure comprises the step of said honeycomb structure having a plurality of multi-sided cells.

10 31. The method as recited in Claim 28 wherein said step of providing a honeycomb structure comprises the step of said honeycomb structure having a plurality of cylindrical cells.

15 32. The method as recited in Claim 28 wherein said step of providing said honeycomb structure comprises the step of providing a matrix of a plurality of strips attached together at cross-over points said strips being made of an impact-resistant material.

20 33. The method as recited in Claim 28 wherein said step of providing a honeycomb structure having a plurality of cells comprises the step of providing at least one piezocomposite element having a 1-3 connectivity configuration in each of said cells.



34. The method as recited in Claim 28 wherein said step of providing a honeycomb structure having a plurality of cells comprises the step of providing at least one piezocomposite element having a 2-2 connectivity configuration in each of said cells.

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